

The Impact Of Technology On Pilot Skills

Posted on January 14, 2020

Abstract

Technological advancements have seen a transformation in unusual ways and methods of performing basic and most complex tasks during flight operations. With technology, new and automated systems with a very high degree of accuracy and reliability have been developed to compensate for human deficiencies that result in errors and tragic accidents. In aviation, technological advancements have made flying and landing aeroplanes safer over time by reducing the rate of occurrences of human error, causing many major aviation accidents in the past. Pilot skills have been reduced through the autopilot and landing systems conducted on the aircraft and at the airport. Pilots have developed increasing over-reliance on machines and complex systems to do their work, which creates safety hazards in the event of mid-air emergencies. Pilots who are unaware or inexperienced in handling in-flight emergencies make it potentially dangerous, risking the lives of everyone on board during system malfunction or failure. The individual project purpose will provide evidence of accumulated accidents where pilots were unaware of necessary recovering skills when an aircraft induced manual flight manoeuvres. The accident reports, as well as the collected data through statistical analysis of crashes involving technology, will identify diminishing pilot skills when automation systems malfunction. The statistical ANOVA analysis will help determine when a pilot becomes dependent on technology during flight operations.

Pilot Dependency on Technology

Technology Advancements Diminish Pilot Skills

Objective: Advancements in aviation technology have increasingly enhanced the automation in aircraft systems, thus leaving pilots with little to do. As a result, pilots' basic aviation skills have diminished since many of the operations are performed automatically. Moreover, pilots have increasingly become unable to gain sufficient manual experience due to the continued use of autopilot technology. Autopiloting renders some critical manual aviation skills obsolete in the long run. Consequently, autopilot has increased the chances of an aeroplane crash in the event of a completely automated system malfunction or erroneous disengaging. The aeroplane crashes might be attributed to neglecting manual piloting necessary to manoeuvre and supplement autopilot.

The dependency on innovative technology to maintain flight conditions during emergencies creates hazards in flight operations. Standard procedures that pilots acquire in manual training to regain control of an aircraft have diminished. Emergency situations often present numerous challenges to

the pilots. Pilots find it perplexing to restore monitoring of the plane due to the complexity of technology and reduced manual piloting skills (Puentes, 2011).

Scope: This project has evaluated automation systems utilized during flight operations and how they impact aviation hazards. The study will focus on aviation accidents and their causes across the world. Though aviation systems have increasingly become reliable, a high percentage of accidents are still **caused by human error and automatic system** failure. It is evident that there have been reduced cases of both commercial and general aviation accidents in recent years. The project will postulate trends in aviation accidents and how technology has been a factor.

Methodology: An evaluation of accumulated Federal Aviation Administration (FAA) and National Transportation Safety Board (NTSB) reports has been used as a source of data from the years 2005 to 2015. This period is selected due to the high technological advancement in aviation. The reports will provide data about flight processes that mainly depend on technology. The reports will also be used to determine the number of accidents arising from the pilot's failure to use technology effectively.

Aviation accidents will be the dependent variable of the study. Aviation accidents are of economic significance, and their minimization is vital. Passengers' safety is crucial, as well as the organization's bottom line. The independent variables of the research will be technology advancement and human error. These two factors highly influence aviation safety and are relevant to the project.

Research Design: The study adopted a quantitative research design. The project will use secondary data on aviation accidents from NTSB and FAA websites. This study will employ a one-way ANOVA analysis of variance approach, which seeks to determine the relationship between the variables associated with a problem (aviation accidents).

Research Questions

The research questions for the project will be:

1. How has technological advancement influenced aviation accidents?
2. Is there any correlation between human error (attributed to diminishing skills) and aviation accidents?

Hypothesis

H_{01} : Technological advancement has no effect on the number of aviation accidents.

H_{a1} : Technological advancement has an increased effect on the number of aviation accidents.

Data and Data Analysis

Data will be derived from both NTSB and FAA reports identifying aircraft accidents involving technology advancements and pilot error. [Microsoft Excel](#) and Stat Crunch will be used as analysis tools. ANOVA analysis variance will be employed as the statistical analysis method for this study.

The statistical analysis was used to gather data from both NTSB and FAA reports and identify accidents that occur when pilots depend on technology. The assumptions for using ANOVA in this study are that the residuals are normally distributed and the data samples are independent. ANOVA requires sample sizes of greater than 15 for each group if the number of groups is from two to nine. If the number of groups is from 10 to 12, then each group needs to have a sample size greater than 20. ANOVA can test the response (aviation accidents), which is called the dependent variable, and the factor variables (technology and human error) are independent (Guthrie, 2010). The dependent variable in this study is the number of aviation accidents, recorded cases of flight mishaps resulting from human error, and mechanical errors (due to technology). The pilot error type is the specific human error that led to the accident. The pilot error will be measured by classifying the flight data associated with autopilot and technology.

The accumulation of the analysis will conclude a 95% confidence interval (CI) in relation to ANOVA and correlation analysis. ANOVA compares the mean values of several variables at one time, whereas the correlation test postulates the nature and strength of the relationship between the dependent and independent variables. A regression analysis will help determine whether a linear relationship exists between the variables of interest.

ANOVA will be used to analyze between three variables for statistical significance. The three identified variables include accidents (percentage of accidents), human error, and automatic system failures. The statistical significance shows that more than chance is (or is not) involved in the behaviour being analyzed. An F-ratio value indicates the difference between conditions and effects when it is statistically significant. ANOVA is a parametric test, so it is more sensitive than non-parametric tests like Spearman's rank correlation coefficient and squared rank test (Guthrie, 2010). The assumption for parametric tests is that the data has to be normally distributed. The means can be tested and then compared because a ratio is calculated by the ANOVA model to analyze multiple groups (Frost, 2015). Parametric tests are considered to have more statistical significance and feasibility than nonparametric tests (Frost, 2015). The power is related to accurately rejecting a null hypothesis when it is false (Frost, 2015).

ANOVA is more advantageous as it helps reduce random variability and highlights the interaction between variables. Other tests in ANOVA can be used to test the normality distribution, such as the Kolmogorov-Smirnov test or producing a graph called the normal quantile plot. The mean variances of gender to the number of accidents can be compared, but causality is not necessarily implied (Park, 2005). The problem with using the t-test for all the variables that can enter into this study is that Type

I errors enter into the analysis of multiple groups of mean variances (Park, 2005).

Program Outcomes

PO #1

Students will be able to apply the fundamentals of air transportation as part of a global, multimodal transportation system, including the technological, social, environmental, and political aspects of the system, to examine, compare, analyze and recommend conclusions.

The research is important as it will identify the process of flight a pilot is dependent on technology. Students will be able to appreciate the dynamic and exponential growth that the industry has undergone and the associated effects (Kaps & Phillips, 2004). Besides, students will appreciate the critical challenges affecting aviation and devise ways of mitigating them. The research findings will pose challenges to ensuring the provision of the most current and efficient knowledge and procedures to minimize over-reliance on autopiloting.

Global evidence will insist on the need to equip and maintain high-level training among pilots to increase emergency skills. More so, the research will recognize the need to equip pilots with the knowledge to effectively manage the ever-developing cockpit environment technology and any other relevant systems used in the cockpit to increase overall flight safety. The political aspects will be developed by the FAA and the NTSB by encouraging mandatory training requirements. The research will provide a body of knowledge in discoveries that pilot skills decrease as innovative technology is implemented into a cockpit. The research will provide evidence from a technological perspective that pilots depend on technology and the effects of dependency on technology. Social evidence will conclude that with increased automation systems in aircraft, pilot skills diminish when automation systems fail during flight and pilots are required to gain control of an aircraft, often leading to confusion and human error mistakes. The environmental aspect of the research will provide information on how pilots react to the cockpit environment when introduced to aircraft with minimal technological advancements.

PO #2

The student will be able to identify and apply appropriate statistical analysis, including techniques in data collection, review, critique, interpretation, and inference in the aviation and aerospace industry.

Statistical skills and knowledge are not only required for effective communication but also for understanding other communications. 'When a result of the research is communicated to the common man, despite avoiding jargon, some elementary ones have to be retained.' (Sridhar, 2011). The research will help the student select the best statistical analysis method, which provides logical and

systematic ways of presenting statistical data in numerical values.

The statistical method to test the hypothesis will be determined based on the shape and graphical characteristics of the graph. The accumulated data plot will provide a correlation between the accidents that occurred and technology as a key element that caused the accident. The research will be organized by accumulating all accidents from the NTSB and FAA reports caused by automation system failures during flight operations between the years 2005 and 2015. The analysis will provide evidence that pilots have established a dependency on technology over the course of the years. The accumulated data will correlate to those who rarely use technology and how fewer accidents are caused when automation systems are not used. Based on a t-test statistical hypothesis, the data will convey whether pilots who use technology diminish piloting skills more than pilots who do not use technology. An ANOVA analysis will help identify if technology has led to diminished skills and dependency on technology for flight operations.

The researcher will complete the analysis of the data using an appropriate statistical method. A 95% CI will be accomplished to provide evidence that pilot skills diminish over time as technology advancements are implemented into the cockpit.

PO #3

The student will be able, across all subjects, to use the fundamentals of human factors in all aspects of the aviation and aerospace industry, including unsafe acts, attitudes, errors, human behaviour, and human limitations as they relate to the aviator's adaption to the aviation environment to reach conclusions.

The fundamentals of human factors will apply in the analysis of human limitations when technology malfunctions. The pilot's encounter with technology over the years of technology implementation in the aviation/aerospace industry will identify how pilot skills have diminished. The unsafe acts of pilot error throughout the years of dependency on automation systems provide evidence from the accumulation of accident reports through the FAA, and NTSB concludes that human behaviour relies on automation systems. The unsafe acts of dependency identify the complicated tasks a pilot faces and the attitude pilots encounter when the automation systems fail during flight operations. Automation of pilots brings in vulnerability as mental rumination happens outside of **conscious awareness** (Schenck, 2011). Students will be able to demonstrate the importance of mindful awareness and autopilot. Appreciation of human factors will have a great impact on the learner that may result in pilot error, culminating in aviation accidents. The analysis will provide solutions to mitigate pilot dependency, such as increasing simulator time and introducing the pilot to increased automation failures during simulation times.

PO #4

The student will be able to develop and apply current aviation and industry-related research methods, including problem identification, hypothesis formulation, and interpretation of findings to present solutions in the investigation of an aviation / aerospace-related topic.

The researcher's hypothesis is that technological advancements have an increased effect on the number of aviation accidents. The data to support the hypothesis will be an accumulation of accident reports associated with automation failures from 2005 to 2015.

The variables compared include human (pilot) errors and technology advancements as the independent variables. The dependent variables in the research will be the percentage of aviation accidents. The researcher will apply concepts in research analysis based on the results of statistical analysis. The researcher will articulate the conclusion and pertinent details to support the conclusion of the research question and hypothesis statements. The accumulation of the analysis will conclude a 95% CI with relation to a t-test and ANOVA. The correlation between accidents, technological changes, and human error will be established and human errors. This research results in how pilots failed to react during flight operations, which is associated with pilot errors involving technology. The research will provide evidence that pilot skills diminish over time when using technology to assist them during flight operations. The evidence will provide a hypothesis on how a pilot is introduced to innovative technology; the more dependent a pilot will become on automation systems to fly an aircraft with the effects of increasing accidents.

PO #9

Aviation Aerospace Safety Systems The student will investigate, compare, contrast, analyze and form conclusions to current aviation, aerospace, and industry-related topics in safety systems, including systems safety, industrial safety, accident investigation and analysis, transportation security, airport safety and certification, safety program management, and aviation psychology.

A systems safety study in the research will conclude the technology advancements and how the implementation is to reduce accidents. The complex automation systems provide confusion when systems begin to fail during flight operations.

The accumulation of FAA and NTSB accident investigation reports will provide evidence in the analysis to enhance safety management. The analysis from the research will identify safety factors in human behaviour by capturing dependent behaviour on technology. NTSB provides detailed reports, statistics and data, which are typically accessible and detailed regarding the circumstances surrounding safety management failures and hazardous events. NTSB and FAA work handily in that they issue recommendations, including recommendations directed to safety issues, weather reporting, and regulatory requirements, to enhance their predictive capabilities (Kolly & Groff, 2002). With the

availability of substantial and rich information, students will be able to carry on more research in the aviation industry.

Transportation security in relation to air travel is considered safer and more secure with advanced technology identifying hazards before boarding an aircraft. As advanced technology is implemented throughout the aviation industry, certain aspects of automation systems during flight create risks where pilots are unaware of the dangers of dependency on technology until it is too late.

The safety program management provides in-flight safety protocols when failures occur in the flight systems. Although security management is useful, other areas of flight emergencies, such as automation failures, need to be revised for accident prevention.

Aviation psychology seeks to research the view that technology can replace human error by controlling the aircraft. The implications are that the pilot's change in behaviour and dependency create psychological changes based on advancing technology in cockpits.

Statistical Analysis

Anova: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Human Error	10	13	1.3	1.78888889		
Technological Error	10	11	1.1	1.65555556		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.2	1	0.2	0.116129032	0.737216584	6.514641777
Within Groups	31	18	1.722222222			
Total	31.2	19				

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The above table illustrates an ANOVA analysis of human error and technology variables. The results show that technology has significantly decreased the number of accidents over the period. Technology variance is lower than human error. It explains the change in fatal accidents in aviation over the period. There is a weak significance level between Human error and technology.

Discussion

Hypothesis H_a : The results support the alternate hypothesis and show a significant impact of technology on aviation/Pilots. After the fatal accidents in 2015 and 2016, we witnessed an average performance regarding safety for air transport in catastrophic disasters. These five deaths continue to emphasize the need for both surveillance and action in all types of operations, such as in the form of goods and passengers, as well as in all types of operating environments. But the overall picture remains positive: the fatal accident of the (fourth) generation last plane remained at the same lower level, and in 2015, an accident with a fatal outcome. As for the losses in housing, industry results were in line with the levels reached in 2010, with the loss of aircraft fuselage 13, which led to a loss of 0.39 million light cycles.

During the past 20 years, the accident rate in the area was divided by about eight accidents and deaths in about 3 to house losses, taking into account all aircraft generation. In the same period, the amount of traffic has increased by more than 86%. This shows that investments in safety are fruitful, improved safety, and the accident is largely avoided. However, when we see increasing levels of congestion at airports and in the air, the relative stability of the sector in modern times can be considered a bit too much.

An earlier fleet forecast anticipated more than 2,000 new aircraft annually by 2019; that projection should be treated historically rather than as a current delivery rate. This growth must be supported by a proportional increase in the number of trained employees, including pilots, engineers, cabin crew, air traffic controllers, and more. Given these trends, we can conclude that if the accident rate remains the same, an increase in the number of accidents in the industry regarding quantity is directly proportional to the increase in this indicator. Simply put, more flights mean more accidents if you do not work to reduce the accident rate.

This is why Airbus believes there is no room for complacency. We believe we have to be ambitious, to give more impetus to our long tradition of improving our industry and questioning ourselves to reduce the rate of accidents than in the past. To achieve this goal, we will have to work together and increase our efforts to increase safety.

Identify the most promising opportunity to respond to emerging risks and emerging threats. Since 1950, deaths have declined from year to year, which is a significant achievement, given the tremendous growth in air traffic since then. In 1959, for every million aircraft departures in the US,

There were 40 accidents with fatal outcomes. At age 10, this has improved at least two out of every one million outlets, and today it is about 0.1 per million. Increased safety is all the more impressive given the increase in air traffic. According to the International Air Transport Association (IATA), in 2014. Airlines around the world registered 3.3 billion passengers in 2014. According to the International Air Transport Association (IATA), it has Last year, fatal accidents and 12 victims.

While the death rate increased significantly from year to year (by 2013, there were 210 deaths), IATA says that commercial aviation safety remains “the lowest in history” due to the loss of One million flights of homes. According to these indicators, the overall level of aviation disasters in 2014 was 0.23, which is equivalent to one accident per 4.4 million flights. It was, in fact, an improvement compared to 2013, when the overall standard home loss was .41 (average of one crash every 2.4 Mill. Flights). They both won over five years (2009-2013) of 0.58 aircraft losses in case of loss per million flights. They date back to 50 years – when all airlines make 141 million passengers – 87 were accidents, in which 1,597 people died.

The improved safety of reduced airlines is due to a combination of several factors, although the introduction of the jet engine in 1950 was an important event. Reactors provide a level of safety and reliability unmatched by previous engines. Nowadays, motor manufacturers are said to have virtually ruled out the possibility of an engine failure.

The introduction of electronics, in particular – the introduction of digital devices, known as the “glass cabin” in 1970, and the appearance of “The flight of wire” technology in 1980 are also important results that helped improve security. It also played a role in improving sensors, navigation tools, and technologies for air traffic management, such as the system that deals with collisions. While the technology has helped improve the safety performance of the air transport sector, it has made major advances in safety management systems and the factors that have contributed significantly.

“Plane crashes – is a chain of events that is almost always associated with the element of human error,” – says Downey.

“However, the safety culture in the air transport sector has changed significantly throughout my career. Flight training has become more controlled, and the professional environment has developed with continuous training. Flight simulators were one of the biggest changes I have ever seen. ”

Periodic training, where drivers and crews improve their skills and prepare for emergencies, was initially introduced in the aviation industry and is now having a positive impact on all areas of aviation, Downey explains. “Security management systems radically changed the view of the human factor in the airline industry and now have an impact on the world of general aviation,” – he says.

Another important development in safety in recent decades has been crew cabin or crew data management and monitoring, which has reduced the risk of human error. For example, the tracking system for onboard personnel data, including digital audio and video recording equipment, is now widely used to determine security trends that could be eliminated through training and to investigate

the causes of accidents. Increased safety is also a reflection of first-class risk management in the airline industry and improves the ability to identify problems before they become serious issues. At present, the effectiveness of safety inspections and investigation of aircraft crashes, improving production technologies and quality control are safer.

“Airlines are increasingly focused on security, but the tools available to manage the risk management services of the airlines and identify problems before they are critical, improved significantly,” – says Shvaygart.

Although the accident rate in 2014 improved further, it is still not related to the fact that the industry can continue to improve safety in the future. According to Thomas Kahlika Mediterranean Chapter, aviation, GATS, further improving security, in all likelihood, can not be guaranteed. Aviation experiences periods of innovations, such as the recent development of composite materials and lithium batteries, which can, however, result in losses.

IATA notes that given the expected growth in air traffic, the loss of housing has doubled without additional safety improvements. It set the goal of further reducing the level of accidents but says it will require new and improved methods of safety management, such as increased use of data analysis. According to IATA, the use of a possible large pool of data collected more than 27 million flights a year, and not just a couple of stretches when something goes wrong, will be the key to improving safety in the future. For example, the aviation industry now aims to make better use of data through the IATA Flight Data Exchange (FDX), which uses data from flight recorders to determine the risk of systemic problems.

The aviation industry's impressive safety record in recent decades largely reflects the technological advances that were introduced and then polished in the second half of the 20th century. The next generation of jet aircraft as a whole has proven to be safer than previous ones. Piston aircraft, which dominated the world of aeroplanes in 1960, has had an emergency measure of 27.2 cases per million departures. The second generation of aircraft in the second half of 1960 – early 1970s, including the jetliner Boeing 727 and DC-9 aircraft, was 2.8 cases per million. IATA's 2025 Annual Safety Report recorded an all-accident rate of 1.32 accidents per million flights, based on 51 accidents among 38.7 million flights. Aircraft design could change more drastically, especially if the flight should remain available as the fuel cost increases in the future. This can lead to the emergence of new forms of movement, such as electric, hybrid or solar motors – a new cell original design, as well as new methods such as plantation above or unreasonable auxiliary.

“After 20 years, we can see a fundamental change in aviation technology due to the economic and environmental problems of fossil fuels,” – says Yozef Shteyngart, chief of aviation in Germany, AGCS. At the same time, the aviation industry has continued to innovate in recent years with the introduction of composite materials and the increasing use of digital technologies and electronics.

“The new generation of aircraft is very innovative, but it will take time, at least a couple of years, to see how resilient materials will be,” – said Thomas Kahlik, head of the Mediterranean Department,

Aviation, AGCS.

Many new technologies have helped improve safety, such as the best screen for flight decks and “flight” systems. However, technology has

The potential for creating unwanted consequences, according to John Downey, chief of aviation – the United States, of GATS.

“One day, the pilots relied on their” guns “and had very little real-time data at hand. Now the information available can be overwhelming,” he said. – he says.

While the “glass cockpit” technology offers a better visual representation, it also causes problems, as seen in Air France Flight 447 losses in 2009, with 228 people aboard. Investigators concluded that aircraft pilots had problems with the hardware and had taken inappropriate actions when the Airbus 330 flew in turbulence during a tropical storm over the Atlantic Ocean. Concerns about pilots’ dependence on the automation booth have also been caused by the Asiana crash in 2013.

It was developed by potential propagation time for commercial transport aircraft operating in international environments and oceans, including reception and viewing of FIS-B meteorological products, dissemination of collision data with aircraft on a ship with other aircraft users And messages from the ground and delivery in the cabin of the ground turbulence with other aircraft. The Swift64 used multiple architectures for data packets through the constellation of Inmarsat satellites. For packages and international services and ocean environments, Inmarsat-I3-based packages were selected. IP (Internet Protocol) was selected as the network protocol, and the onboard cracking algorithms were evaluated for the separation of the packet data service between the cabin and the cabin.

Progress in the field of climate information dissemination was significant but was based on the innovative use of existing or planned data channels. Data and meteorological information are expected to increase, along with other requirements for connection to a new generation of air traffic management, safety, and security, requiring broadband, which serves all aircraft. Future communications systems should also consider the possibility of cross-linking, improved ground and air data processing and composite routing / flexible schemes. These future possibilities will be realized only if the equipment and services support the networks and provide access to the data that may be available. Large commercial systems free users, such as real and high-value aircraft for mobile satellite communications, may be the key to providing these essential features at a reduced cost.

The technologies have been developed by NASA in collaboration with the FAA, NOAA, industry and research community, allowing more accurate and timely flight conditions and allowing pilots in flight to make decisions that lead to Safer and more efficient work. Developed and implemented the technology of information systems in the information in time for the first generation of information systems. It developed a second-generation system that can combine information from the data lines and sensors on board, evaluate, and provide time warnings. Skill was developed to detect turbulence

and demonstrate the seriousness of 25 nm for commercial air transport. For commercial air transport, automated reporting of turbulence encounters has been developed. The time of the automated reporting is in place to ensure that the aircraft observations improve the forecast and to identify longer time areas. The data-developed technologies provide convenient and reliable transmission of text and time graph products from the ground in the cabin. It was developed and approved by distribution data transmission lines for next-generation systems.

Conclusion

This study provides information on the various factors associated with fatalities. The man is still the weak link of machine dynamics. However, better selection, training, and good supervision, of course, reduce/prevent a pilot error to a minimum. This study provides valuable data for understanding the aetiology of pilot error and the development of prevention strategies. It also suggests that pilot error is not simply a function of human nature and is defined as exogenous and endogenous variables that are sometimes predictable. Environmental stresses that increase productivity often play an important role in causing a pilot error and fatal air crashes. To minimize driver error, increasing productivity through safety training may be useful, but it has its limitations. Development and application of technologies that reduce pilot effectiveness in hazardous situations are more effective. "Deaths in typical accidents can be called a model age of 24 to 26 years with the MiG-21 Class / White Operations with approximately 200 flight hours in the type that flies from 1100 to 1600 hours, is incorrect or in the way of organisms or manifestation of evil powers in the lack of knowledge of the situation misuse inspection ".

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